CROSS SECTIONS FOR K-SHELL IONIZATION OF ATOMS BY ELECTRON IMPACT

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Cross sections for K-shell ionization of atoms and molecules by electron impact are needed in many applications, such as the modeling of radiation effects in materials and in biomedical research, and modeling of fusion plasma in tokamaks, as well as in basic theory for atomic and molecular collisions. For instance in biomedical research, the energy-dependent cross section for K-shell ionization by electron impact of atoms, such as carbon, nitrogen, and oxygen play an important role in the study of radiobiological effects through Auger electrons [1].

Kim and Rudd proposed in 1994 the binary-encounter-Bethe (BEB) model [2]. The BEB model was used to calculate total ionization cross sections of neutral atoms and molecules with great success [3] for nonrelativistic incident electron energies.

When the incident electron energy *T* exceeds about 20 keV, as in inner-shell ionization of heavy atoms by fast electrons and stripping of fast ion projectiles used in heavy ion fusion, one needs to take relativistic interaction between the incident and target electrons into account. In a recent article by Kim, Santos and Parente [4], the nonrelativistic BEB and associated formulas for the total ionization cross section were extended to relativistic incident electrons. The relativistic version will be referred to as the relativistic BEB (RBEB) model. To handle inner-shell ionization, such as the K-shell ionization, the BEB model was slightly modified to account for the strong nuclear field experienced by the incident electron when colliding with inner-shell electrons. Comparisons to experimental data on carbon, argon, nickel, niobium and silver presented in Ref. [4] have demonstrated that the K-shell ionization cross sections calculated using the RBEB model are in excellent agreement with the experiment except for silver.

To calculate K-shell ionization cross sections, the RBEB model requires only three constants for each atom, the binding energy *B* and the kinetic energy *U* of the K electrons and the occupation number N, which is two for a fully occupied K shell. In this work we present *B* and *U* for carbon through antimony with the atomic number *Z* from 6 (carbon) to 51 (antimony). In addition, RBEB cross sections for K-shell ionization are compared to available experimental and theoretical data on nitrogen, oxygen, sodium, aluminum, chlorine, calcium, copper, selenium, and antimony.

Work at CFA was supported in part by FCT-Portugal (POCTI/C/FIS/10030/98) and by FLAD, ant at NIST was supported in part by the Office of Fusion Energy Sciences, US DOE.

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